I claim:

1. A cell containment apparatus comprising a cell tray comprising a substrate, a multi-dimensional array of apertures on the substrate, a medium disposed in the apertures for monitoring, analyzing and processing of properties of the medium.

2. The apparatus of claim 1, wherein the apertures are cell wells receiving the medium to be analyzed.

3. The apparatus of claim 2, wherein each cell well (cubicle or silo) is disposed equidistant from an adjacent cell well in an orthogonal direction.

4. The apparatus of claim 1, wherein the array is a linear array or two-dimensional array.

5. The apparatus of claim 1, wherein the medium is a life support medium.

6. The apparatus of claim 1, wherein the medium is a solid or fluid sample.

7. The apparatus of claim 1, wherein the medium is selected from a group consisting of matrix of cells, biological fluids, chemicals, solid analytes, and combinations thereof.

8. The apparatus of claim 2, further comprising a probe disposed proximal the substrate for simultaneous monitoring, analysis and processing of the medium in each cell well.

9. The apparatus of claim 8, wherein the probe is an array of probes for parallel processing of the medium in each of the cell wells.

10. The apparatus of claim 9, wherein the probe is a precision optical intracellular near field imaging spectroscope.

11. The apparatus of claim 10, wherein the spectroscope comprises a nanosensor array of probes for non-invasively imaging sub-cellular and molecular inner regions of the medium being analyzed without destruction of the medium.

12. The apparatus of claim 11, wherein the nanosensor array of probes are

near-field probes for intra-cellular sub-wavelength resolution imaging of the medium in the cell wells.

13. The apparatus of claim 9, wherein the array of probes have spacings between the probes similar to spacings between the cell wells.

14. The apparatus of claim 13, wherein one probe of each of the array of probes monitors, processes and analyzes the medium in one of the cell wells proximal the one probe, and wherein the array of probes parallelly monitor, process and analyze the medium in the cell wells as desired.

15. The apparatus of claim 1, wherein the substrate comprises material having optimal transmission properties in all regions of an electromagnetic spectrum.

16. The apparatus of claim 1, wherein the substrate is an optical substrate.

17. The apparatus of claim 16, wherein the material of the optical substrate is selected from the group consisting of fused silica, soda lime glass, borosilicate glass, PMMA, sapphire, silicon, germanium, and combinations thereof.

18. The apparatus of claim 1, wherein the substrate comprises a photoresist coating.

19. The apparatus of claim 18, further comprising a crossed-grating pattern of Ronchi-grating on the photoresist coating.

20. The apparatus of claim 18, further comprising a lithographic shadow mask forming the apertures on the photoresist coating.

21. The apparatus of claim 18, further comprising a crossed-grating interference pattern on the photoresist coating formed by holographic exposure.

22. The apparatus of claim 18, further comprising a two-dimensional ordered array of shaped regions formed on the photoresist coating.

23. The apparatus of claim 22, wherein the shaped regions have geometric shapes selected from the group consisting of circles, triangles, squares, rectangles,

rhombus, pentagons, hexagons, octagons, and combinations thereof.

24. The apparatus of claim 18, further comprising an intermediate layer between the substrate and the photoresist coating.

25. The apparatus of claim 18, wherein the cell wells have different well depths on the substrate.

26. The apparatus of claim 2, further comprising optic lenses disposed at bottoms of each of the cell wells.

27. The apparatus of claim 26, wherein the optic lenses are micro-machined diffractive optic lenses.

28. The apparatus of claim 26, wherein the optic lenses are Fresnel lenses.

29. The apparatus of claim 1, wherein the substrate is a uniform flat surface.

30. The apparatus of claim 29, wherein the substrate is a microscope slide or a cover slip.

31. The apparatus of claim 30, wherein the substrate is an invar backing plate comprising clear apertures for viewing transmission.

32. The apparatus of claim 2, wherein the cell wells are micro-channels etched into the substrate for delivering the medium to each cell well.

33. The apparatus of claim 32, further comprising a delivery manifold, substances in the manifold, and fluid channels on the substrate connecting the manifold and the cells wells for delivering the substances to the cell wells.

34. The apparatus of claim 33, wherein the substances are selected from the group consisting of drugs, chemicals, dyes, fluids, and combinations thereof.

35. The apparatus of claim 1, wherein the cell tray is a square ordered array of cells.

36. A method for analyzing a medium comprising providing the medium in a multi-dimensional array of cell wells on a substrate of a cell tray in a cell containment

apparatus, and simultaneously monitoring, analyzing and processing the medium and determining properties of the medium.

37. The method of claim 36, wherein the providing the medium comprises providing a life support medium.

38. The method of claim 37, wherein the providing the life support medium comprises providing a solid or fluid sample.

39. The method of claim 36, wherein the providing the medium comprises providing the medium selected from the group consisting of matrix of cells, biological fluids, chemicals, solid analytes, and combinations thereof.

40. The method of claim 36, further comprising disposing a probe proximal the substrate for the simultaneous monitoring, analyzing and processing of the medium in each cell well.

41. The method of claim 40, wherein the disposing the probe comprises disposing an array of probes and parallelly processing the medium in each of the cell wells.

42. The method of claim 41, wherein the parallelly processing comprises imaging the medium with a precision optical intracellular near field imaging spectroscope.

43. The method of claim 42, wherein the imaging comprises non-invasively imaging sub-cellular and molecular inner regions of the medium with a nanosensor array of probes without destroying the medium.

44. The method of claim 43, wherein the imaging with the nanosensor array of probes comprises imaging intra-cellular sub-wavelength resolution of the medium in the cell wells with the near-field probes.

45. The method of claim 44, wherein the imaging with the probes comprises imaging the medium in one of the cell wells with one probe of each of the array of probes

proximal the one cell well, and parallelly monitoring, processing and analyzing the medium in the cell wells with the array of probes.

46. The method of claim 36, further comprising imaging the medium with optic lenses disposed at bottoms of each of the cell wells.

47. The method of claim 46, wherein the imaging with the optic lenses comprises micro-machining diffractive optic lenses at the bottoms of each of the cell wells for optical transmission and processing of the medium in each of the cell wells with a spectroscope or a microscope.

48. A process for fabricating a cell containment device comprising forming a cell tray with a substrate, forming an array of cell wells on the substrate, providing a medium of interest in the cell wells, and imaging the medium in the cell wells.

49. The process of claim 48, wherein the forming the cell tray with the substrate comprises forming a substrate with optimal optical transmission properties in all regions of an electromagnetic spectrum.

50. The process of claim 49, wherein the forming the cell tray with the substrate comprises forming a substrate with material selected from the group consisting of fused silica, soda lime glass, borosilicate glass, PMMA, sapphire, silicon, germanium, and combinations thereof.

51. The process of claim 49, wherein the forming the cell tray with the substrate comprises coating the substrate with a photoresist layer.

52. The process of claim 51, wherein the forming the cell wells comprises exposing a crossed-grating pattern with a Ronchi-grating on the photoresist coating.

53. The process of claim 51, wherein the forming the cell wells comprises masking with a lithographic shadow on the photoresist coating.

54. The process of claim 51, wherein the forming the cell wells comprises holographically exposing a crossed-grating interference pattern on the photoresist coating.

55. The process of claim 18, wherein the forming the cell wells comprises forming a two-dimensional ordered array of shaped regions on the photoresist coating.

56. The process of claim 55, wherein the forming the shaped regions comprises forming regions with geometric shapes selected from the group consisting of circles, triangles, squares, rectangles, rhombus, pentagons, hexagons, octagons, and combinations thereof.

57. The process of claim 51, wherein the forming the cell tray with the substrate comprises exposing the photoresist layer with laser light or broadband white light.

58. The process of claim 57, further comprising after developing the substrate, retaining unexposed portions on the photoresist layer as surface structures, and forming a two-dimensional ordered array of geometrically shaped regions on the substrate.

59. The process of claim 58, wherein the exposing the photoresist layer comprises exposing with negative or positive photoresist processes.

60. The process of claim 59, wherein the exposing the photoresist layer comprises substituting the positive photoresist process with a negative of an aperture mask.

61. The process of claim 58, wherein the forming the cell wells comprises forming the cell wells with e-beam or deep UV lithography on the substrate.

62. The process of claim 48, wherein the forming the cell tray with the substrate comprises forming a substrate with material selected from the group consisting of soda lime glass, borosilicate glass, fused silica, PMMA, sapphire, silicon, germanium, and combinations thereof.

63. The process of claim 61, further comprising processing photoresist patterns on the substrate with reactive ion etching procedure, differentially etching the substrate and the photoresist layer, and etching features into the substrate deeper than a

thickness of the photoresist layer.

64. The process of claim 63, wherein the differentially etching the substrate comprises forming various well depths of the cell wells.

65. The process of claim 63, wherein the differentially etching comprises etching with a fluorine based chemical etchant.

66. The process of claim 65, further comprising forming deeper cell wells by disposing an intermediate layer between the substrate and the photoresist layer.

67. The process of claim 66, wherein the disposing the intermediate layer comprises depositing an aluminum layer impervious to the fluorine based chemical etchant, removing the metallic layer, and etching the deeper cell wells in the substrate.

68. The process of claim 48, further comprising imaging the medium of interest with a probe.

69. The process of claim 68, wherein the imaging with the probe comprises fabricating an array of probes with spacing identical to spacing between the cell wells, parallelly and simultaneously processing, monitoring, and analyzing the medium of interest in the cell wells.

70. The process of claim 48, wherein the imaging comprises incorporating a diffractive optic lens at bases of each cell well, microscopically imaging and analyzing the medium of interest using solid and liquid immersion optical techniques for high-resolution imaging.

71. The process of claim 70, wherein the incorporating comprises micro-machining the diffractive optic lens as an integrated part of the cell tray during the micro-machining to generate the cell wells.

72. The process of claim 71, wherein the incorporating comprises forming a fresnel-type lens structure at the base of each well with a binary transmittance or grayscale mask, and a phase mask or kinoform.

73. The process of claim 48, wherein the imaging comprises integrating the cell tray with a microscope objective lens array, disposing the lens array above a sample of interest, and processing and analyzing the sample of interest.

74. The process of claim 48, wherein the forming the cell tray with the substrate comprises mounting the cell tray onto an invar backing plate with a clear aperture for viewing transmission.

75. The process of claim 74, wherein the mounting the cell tray comprises forming a mechanical support and maintaining a uniform flat surface of the cell tray.

76. The process of claim 48, further comprising indexing each cell well with an automation system, and monitoring and processing the medium of interest.

77. The process of claim 76, wherein the imaging comprises simultaneous collection of light for imaging by the indexed cell wells and spectroscopy analysis of the medium of interest in multiple regions of an electromagnetic spectrum.

78. The process of claim 77, wherein the imaging comprises using the cell tray in transmission or reflection mode microscopes and spectrometer configurations in ultraviolet, visible and infrared regions of the electromagnetic spectrum.

79. The process of claim 48, wherein the forming the cell tray comprises machining the cell tray into microscope slides or cover slips or optical substrates.

80. The process of claim 48, wherein the forming the cell tray with the substrate comprises etching an integrated network of micro-channels into the substrate, and providing medium delivery to each cell well.

81. The process of claim 80, wherein the etching comprises forming the network as flow channels on the substrate using photolithography transfer process or shadow mask, dedicating a delivery channel to each cell well, and extending the channel from each cell well to an edge of the substrate.

82. The process of claim 81, further comprising coupling a delivery manifold

to the substrate, communicating the delivery channels of the cell wells with the manifold, providing substances in the delivery manifold, and supplying the substances from the delivery manifold via the delivery channels to the cell wells.

83. The process of claim 82, wherein the supplying the substances comprises supplying substances selected from the group consisting of drugs, chemicals of different concentrations, chemicals of different pH, dyes, and combinations thereof.

84. The process of claim 48, wherein the forming the cell tray with the substrate comprises forming an integrated micro-optic chip on an optical wafer substrate for parallel processing and analysis of a large number of cell wells, and regulating and precisely delivering substances to each cell well.

85. The process of claim 48, further comprising integrating an array of probes with the cell tray, and simultaneously imaging and analyzing the cell wells with the array of probes.

86. The process of claim 85, wherein the integrating comprises integrating near-field probes at bases of the lenses in the cell wells, imaging intra-cellular structure in the medium of interest with sub-wavelength resolution imaging and spectroscopy, coupling the integrated probe and the cell tray to a precision focus control device, and directly viewing inside the medium of interest by non-invasively penetrating a membrane on the medium of interest, and imaging insides of an intact medium without destroying the structure.

87. The process of claim 86, wherein the imaging insides comprises bio-medical imaging, surface metrology and nanoscale chemistry of the medium of interest.